Evaluation of a Telemedicine Service Run with a Patient-centred Care Model

Berglind SMARADOTTIR[a,1], and Rune FENSLI[b]
[a] *Clinical Research Department, Sørlandet Hospital HF, Norway*
[b] *Department of Information and Communication Technology, University of Agder, Norway*

Abstract. The number of patients with chronic conditions and multi-morbidities is increasing, addressing a need for patient-centred care. The research project *Patients and Professionals in Productive Teams* aims to study patient-centred teamwork for this patient group. This paper presents an evaluation of a telemedicine service for chronic obstructive pulmonary disease patients run with a patient-centred care model. Observations and interviews were made to study the technology use and information flow. The results showed that the technology worked well in a patient-centred care perspective, even though the system was a standalone system for telemedicine services. The information in the system was only available for professionals providing the telemedicine services and was not shared with other health care providers.

Keywords. Telemedicine, health technology assessment, patient-centred care

1. Introduction

Health services are facing challenges of providing individualised treatment to a growing ageing population prone to long-term conditions and multi-morbidities [1]. There is a need to understand how to operationalise patient-centred, integrated and pro-active care, supported by technology. In this context, the research project *Patients and Professionals in Productive Teams* (3P) has the aim to study health care services models that are run with a multidisciplinary patient-centred teamwork approach [2]. 3P is a 4-year long project (2015-2019) funded through Helseforsk, a cross-regional health research fund owned by the four Norwegian Regional Hospital Trusts [3]. Ten research groups are focusing on different aspects of patient-centered teamwork service models, such as technology support and medical outcomes. The 3P project involves four innovation arenas that utilise patient-centred team models, located in different health regions of Denmark and Norway. This paper presents a study on the technology support and information flow made in one of the innovation arenas, Lyngby-Taarbæk municipality in Denmark, where a telemedicine service for chronic obstructive pulmonary disease (COPD) patients was run in collaboration with an eDoctor service based on the Epital Care Model [4]. The model has the aim to support the independent life and self-management of the citizens by providing telemedicine services, in line with the Chronic Care Model [5][6]. COPD has been predicted as the

[1] Corresponding author, Clinical Research Department, Sørlandet Hospital, Post Box 783 Stoa, N-4809 Arendal, Norway. E-mail: berglind.smaradottir@sshf.no

fourth fatal disease globally in 2030 [7] and the patient group is prone to exacerbations requiring frequent hospital admissions [8]. In this context, the Epital Care Model aims to provide individualised care by treating COPD patients at home or at a municipal local health clinic to avoid hospitalisation. The research questions (RQs) stated for the study were:

RQ1: *How does technology support the communication and information flow at the telemedicine service?*

RQ2: *What are the benefits and constraints of the telemedicine technology in a patient-centred care perspective?*

2. Methods

Qualitative research methods [9][10] were applied in the study of the telemedicine service, performed in September 2017. A total of 8 informants contributed to the study, including health care professionals, patients and a family member. A group interview was made with 4 informants, (three COPD patients and one family member), followed by individual interviews. Three physicians were interviewed addressing organisational and technical issues of carrying out telemedicine. A workshop on benefits and constraints of the information flow and reflections on how to optimise it in the future, was made together with one patient and two physicians. A field visit was made to the telemedicine service hosted by a nurse, with a practical demonstration of the technology involved. Later, a detailed demonstration was made on a large screen of the telemedicine technology to show the user interface and implemented functionalities. The collected data consisted of audio-video recordings and annotations, that were analysed and categorised into three main groups inspired by [11]. The Norwegian Centre for Research Data approved the study, with project number 53771. All informants participated voluntary and signed a consent form.

3. Results

The telemedicine service was organised as a municipal health service, with nurses responsible for running the daily operations and an eDoctor service available for consultations. The service was established to support the active and independent living of the COPD patients of the municipality, and available for the citizens that could benefit from the procedure. The patient could self contact the telemedicine service for inclusion in the remote monitoring procedure. As a part of the inclusion procedure, a physician from the eDoctor service visited the patient at home for medical examination and registrations. A tablet was connected, and user training provided. The equipment was owned by the municipality and was permanently borrowed out to the patient. The eDoctor service was responsible for medical treatment and advises during the telemedicine intervention, in close collaboration with the nurses. Each patient had a personalised treatment plan and a set of medication available at home in a kit. The patients used the telemedicine service mainly during deteriorations, and not for daily measurements and follow-up. As the telemedicine service was municipal, there was a team of nurses that could attend the patient at home, and in addition, there was a municipal local health clinic for short stays. The telemedicine service worked as one-point-of contact for the enrolled patients. The nurses contacted the eDoctor service and

other related health service providers such as the pharmacy when needed due to medical circumstances. The telemedicine service was available at day-time during weekdays.

Two technical system were developed for this particular telemedicine service: 1) Appinux for overview of enrolled patients and 2) EpiProcess, a Windows-based open source web-service that was process-oriented. Appinux was evaluated as a system that was easy to use, user-friendly and providing a good overview, but one weakness was that it was not a clinical system, so EpiProcess had to be used in parallel. EpiProcess was developed to support the clinical workflow in telemedicine monitoring. It was through a broadband access connected to a centralised data server for storage. It had some limitations, such as lack of integration with Appinux and not having classification or separation of notes which made the overview overloaded. The system had a lack of standards and was not technically integrated with other health care providers, meaning that electronic messages could not be sent. An exception was citizens receiving municipal health care services, for those messages could be sent to the municipal care system.

The patient at home used a tablet, with a pulse oximetry and spirometer connected through Bluetooth. The tablet had a clear user interface providing a good overview, it was evaluated as easy to send measurements and the video-conference function was explained as important. The patients expressed that it was practical to bring the equipment during journeys, only needing network connectivity for using the service. As a future improvement, it was suggested that patients should be able to use their own smartphone device instead of borrowing a tablet. The nurse used a desktop for logging into the management system. The measurements sent in by the patients had early warnings to detect deterioration and the system provided decision support. The information in the telemedicine system was available only for the telemedicine nurses and the eDoctor service. When enrolling a patient into telemedicine monitoring, no notification was sent to the patient's GP or pulmonologist. The telemedicine system did not have a function to send messages or written instructions to the patient's tablet, to be used for confirming oral information.

4. Discussion

This paper has presented a study of the technology use and information flow at a telemedicine service driven with a patient-centred care model. The research questions (RQs) are answered based on the results.

For RQ1, asking about how the technology supported the communication and information flow at the telemedicine service. The telemedicine service was run with a person-centred care approach, putting the citizen and his/her needs at the centre and it was established as a sustainable service, in line with the European Union Health Strategy [12]. The study showed that the telemedicine system was a tailored system designed and developed to carry out person-centred telemedicine follow-up of COPD patients. It was described as well functioning, but it was run beside the municipal EHR and administrative systems. There was limited electronic communication with other health care providers such a GP and hospital specialists.

RQ2 asked about benefits and constraints using telemedicine technology in a patient-centred care perspective. The study identified both strengths and weaknesses with the technology used. Addressing patient-centred care, it was beneficial that the service was run as a municipal supplement to the other health care services, for instance municipal

nurses could attend patients at home when needed in addition to video-conference with telemedicine nurse or the eDoctor. The individualised care was beneficial for the patients, and the telemedicine measurements and consultations were mainly carried out in worsening of the patient's clinical conditions, which might be good for the adherence to the intervention. In other studies, the patients have made daily measurements [13][14], which might cause drop outs or lack of adherence to the service. In the tablet application, the patients had access to the history of measurements but could not access their own information in the management system. A constraint in the daily operation was the lacking function of sending a message to the patient's tablet, to confirm oral information for instance on temporary medication adjustments. The technical solution used for the telemedicine service was suited for patient-centred teamwork that incorporated personnel at the service, but there was lack of technical integration with other health providers.

This study has some limitations, such as a limited number of informants. However, the study participants had different professions and backgrounds, meaningfully representing the target user group. The main contribution lies on the evaluation of benefits and constraints, applicable and transferable to other contexts. Future research agenda targets a continued evaluation of the innovation arena, including a comparison of the results with the other three arenas.

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